

Recommendations to the U.S. Commission on Ocean Policy Pacific Northwest Regional Meeting

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Mr. Chairman and members of the Commission, thank you for the opportunity to present testimony on critical issues for ocean and coastal governance, stewardship, research, and education in the Pacific Northwest and United States. I represent a group of students from Oregon State University who have been examining ocean policy issues this past quarter as part of our studies. As future managers of marine and coastal resources, we hope our recommendations will aid the Commission in its efforts to develop a more focused and integrated ocean policy for the nation.

This testimony is not comprehensive, but does cover some of the most important issues we investigated, along with brief findings, and specific recommendations. It is organized according to the broad themes around which the Commission itself is organized: Ocean Governance, Stewardship, and Research, Education and Marine Operations.

OCEAN AND COASTAL GOVERNANCE

In addressing this set of issues, we follow the lead of Biliana Cicin-Sain and Robert Knecht, who characterize ocean governance as the “architecture and makeup of the regime used to govern behavior, public and private, relative to an ocean area and the resources and activities contained therein.”

Issue 1: Integrated Management—No overarching national ocean and coastal governance framework exists to coordinate among and within disparate public and private interests.

The ocean and coastal zone of the United States is one of the largest and richest of any nation in the world yet there is no overarching national policy for its sustainable development. With some exceptions, however, the current management framework for ocean and coasts in the United States consists of a bewildering array of independent, sector-driven management regimes, laws, and regulations implemented by agencies at the federal, state, and local level, and often in direct conflict with each other. While the U.S. currently lacks a coherent national framework for ocean governance, one could be developed, consisting of a National Ocean Council and a network of Regional Ocean Councils where state and local interests, as well as federal, are represented.

Earlier attempts at establishing federal level marine councils have focused on science, technology, and interagency coordination, but have avoided direct management and governance issues, and had little if any authority. Critical national issues such as rebuilding marine fisheries, restoring and maintaining coastal water quality, coping with the impacts of climate change, and enhancing recreational use of the beaches demand much-improved coordination and collaboration

among the many federal agencies and programs that have responsibilities for these and similar issues.

At the same time, these and other issues have unique regional expressions, owing to differences in physical and ecological factors, management issues, economic conditions, and cultural norms. Solutions also have regional flavors. Further, most would agree that marine resource users and managers in a region know their area and problems best. Similarly, states need an effective mechanism by which to address transboundary issues, such as water quality, migratory species, and oil and hazardous substance transportation. An example of a current state-level transboundary issue is the listing of Southern Oregon/Northern California Coast Coho Salmon under the Endangered Species Act. State water law and land use policies directly impact this species, but no entity exists to evaluate or coordinate state water policy or land policy.

Regional entities currently exist in the Pacific Northwest, such as the Pacific Fishery Management Council, Pacific Marine Fisheries Commission, and Western Governor's Association. However, most of these organizations are focused on a limited set of issues and lack the expertise or authority to deal with multiple use ocean management.

Recommendation 1-1: Create an adequately empowered "National Ocean Council" in the executive branch, established first by a presidential order and supported by legislation. Coordination and harmonization should be part of the primary functions but the Council should also hold decision making authority and accountability for the nation's oceans. The Council would be comprised of leaders of key ocean agencies such as the National Oceanic Atmospheric Administration, Environmental Protection Agency, National Park Service, U.S. Geological Survey, U.S. Department of Defense, and the U.S. Coast Guard. In addition to federal agencies, representatives of "Regional Ocean Councils" would be members of the National Ocean Council. The National Ocean Council would provide support for regional management efforts, and would have adequate authority to intervene if regional efforts, or a single purpose federal agency, have not sufficiently protected nationally important resources. Once authority has been established for a National Ocean Council, the success of current governance regimes can be examined, existing legislation simplified and integrated, and holes identified. To minimize conflict between competing interests, national prioritization for resource use and development must be established.

Recommendation 1-2: Formally establish a network of "Regional Ocean Councils." Each council will address shared problems and work to establish joint management of regional resources with the federal government. The regional councils would consist of representatives of state and local governments, as well as academia, non-governmental organizations, economic interests, and scientists. The Regional Ocean Councils could facilitate workshops in which data and lessons are shared. Local agencies and stakeholders will be empowered in the management of regional resources, thus minimizing resistance to a distant central authority.

Issue 2: State Ocean Management—Improved state-level capacity for management of an expanded territorial sea is needed.

Most state coastal management programs (CMPs) focus mainly on the land side of the coastal zone, despite the strong interests of its citizens in clean coastal waters and sustainable marine industries. Few states have robust ocean management strategies for the adjacent territorial sea, despite state control of the 3-nautical miles adjacent to the coast. Coastal communities have legitimate interests in the state waters and beyond into the territorial sea and should be encouraged to manage them accordingly.

Findings: States and local units of government have legitimate interests in the state waters and territorial sea and should be encouraged to manage them to the fullest extent of their authorities. States and local communities reap both the benefits and costs of marine resource use and overuse, and thus need to be actively involved in ocean management.

The state of Oregon, we believe, serves as an example of a state taking an initiative to demonstrate its economic and environmental interests within and beyond state waters into the waters of the United States EEZ, despite a lack of federal guidance. The state has demonstrated direct and immediate interest in resources such as marine fisheries up to 85 miles offshore, in a zone defined as the *Oregon Stewardship Area*.

Recommendation 2-1: Through amendments to the Coastal Zone Management Act and/or the Outer Continental Lands Act, expand and clarify the state role in management of the expanded territorial sea. This is necessary to eliminate the ambiguous management of ocean resources and uses between the 3-nautical mile state boundary and the 12-nautical mile federal boundary of the territorial sea. The coastal states should be required develop plans for the additional nine miles of territorial sea into existing state CZM programs so that the plans will have legal standing and benefit from federal consistency. The federal government could support this effort by providing grants for the development of state ocean plans.

Issue 3: International Leadership—United States lacks effective leadership roles in international ocean affairs due to nonparticipation in key international treaties.

The United States has yet to become a signatory of the 1982 United Nations Convention on the Law of the Sea (UNCLOS). Lacking ratification, the U.S. does not have the capacity to become an active participant in management of the global oceans, nor can it work effectively to improve several of the treaty's provisions.

Findings: While the U.S. has been able to take advantage of some of UNCLOS treaty provisions, such as the establishment of a 200-nautical mile (nm) Exclusive Economic Zone and a 12-nm territorial sea, the nation could gain good will and leadership initiative by lending its support to this international agreement.

The Commission on the Limits of the Continental Shelf (CLSC) is an important forum for establishing a management system for fuel and other non-living resources of the continental shelf. The U.S. could be prohibited from declaring a claim to any part of its continental shelf beyond 200 miles if it does not consent to UNCLOS by 2004. As was discussed during the USCOP meeting in November, the “treaty provides the only recognized means for gaining authority” over the continental shelf.

The International Tribunal for the Law of the Sea (ITLS), which was established to resolve disputes between nations, may not be used to its full capacity without the participation of the U.S., but the U.S. is not allowed to have a representative on the ITLS until it ratifies the treaty. Since the U.S. failed to sign-on to UNCLOS by February of this year, the nation unfortunately will not have another opportunity to be elected to the ITLS until 2005.

Recommendation 3-1: Recognizing that Ocean Commission unanimously agreed in November 2001 to urge the U.S. to “promptly and expeditiously move forward” with support of UNCLOS and that President Bush supports the U.S.’s adoption of the treaty, it is recommended that USCOP continue to work with the Bush Administration to ensure that ratification takes place as soon as possible. Upon signing the treaty, the U.S. should petition to gain positions on the Commission on the Limits of the Continental Shelf and the International Tribunal for the Law of the Sea. In addition, there are several areas within UNCLOS that should be strengthened:

- a) While a Fish Stocks Agreement exists within UNCLOS, fisheries were not defined on an ecosystem basis. Instead, marine living resources are considered separately for high seas and for national waters. Open access of the seas, where there is a lack of regulation of fishing efforts and no incentive to conserve natural resources, should be eliminated.
- b) Management of deep sea mineral resources was not resolved by UNCLOS. The value of these minerals, such as manganese nodules, is high enough to warrant extraction. An international protocol must be established prior to mining.
- c) A global forum within the United Nations should be established, where ocean issues may be discussed among national and international entities, as well as economic and non-governmental interests. Such a forum will provide supervision of international ocean decision making, and increase process.

OCEAN AND COASTAL STEWARDSHIP

Issue 4: Biodiversity, Protected Areas, and Tourism—Loss of marine species diversity and abundance degrades both marine ecosystems and the industries that depend on them, particularly marine recreation and tourism

Findings: Ocean recreation and tourism, including beach activities, boating, sport fishing, diving, surfing, birding, and related activities comprise one of the largest and fastest-growing industries in the United States, worth many billions of dollars to the nation’s economy. Marine resources and habitats that support these industries, however, continue to decline in quantity and quality, threatening the livelihoods of tens of thousands of Americans.

Planning and development for tourism and recreation has been neglected by coastal management due to predominantly private control of the industry. Tourism has been viewed as an economic option that is relatively easy to plan for and develop, typically requiring few resources. Recent studies on environmental and social impacts of poorly planned tourism infrastructure have revealed that it can deteriorate both the coastal environment and quality of life for inhabitants. Active planning of the industry must occur in order to maintain healthy ecosystems and vibrant Northwest coastal communities.

Recommendation 4-1: To protect marine biodiversity and the ocean and coastal recreation and tourism industries that depend on healthy marine ecosystems, the federal government should speed up the processes for designating Marine Protected Areas (MPAs) and Marine Reserves (MRVs), both through the National Marine Sanctuary Program and the fishery management council process. The process of creating MPAs/MRVs will need to consider all stakeholders in order to evaluate the impacts on the natural and socio-economic environment, including tourism and recreation. This inclusion will facilitate program success through community-level support and enforcement. The management of these areas should be based upon interagency and stakeholder cooperation and collaboration. Jurisdiction may depend upon the purpose of the MPA or MRV, but such programs should come under the purview of a new National Ocean Council and its regional counterparts.

Recommendation 4-2: Amend the Coastal Zone Enhancement Grants portion (Section 309) of the Coastal Zone Management Act to require assessments of the management and research needs for sustainable marine and coastal recreation and tourism. Section 309 has been an important tools for improvement of state coastal programs, but tourism is currently not included as an application issue of concern.

Issue 5: Fisheries Monitoring—The dire status of the West Coast groundfish fishery is an example of the need for better baseline data and more effective monitoring of fishing to more accurately assess and manage species.

Findings: Less than 23% of the known species of West Coast groundfish are adequately assessed by surveys and historic catch analysis by the National Marine Fisheries Service (NMFS). Bycatch in the trawl fisheries remain serious threats to the health of depressed stocks.

Recommendation 5-1: Properly buffered MRVs should be established utilizing newly developed habitat bathymetric mapping to determine the type of essential fish habitat included in the reserve. Through low impact research, these MRVs will address how present natural environmental conditions affect the potential carrying capacity of species. Remotely or autonomously operated vehicles should be used in the assessment to record species density and habitat preferences as well as ocean conditions. In addition to the MRVs, MPAs need to be designed to research how ecosystems respond to human disturbances. This will aid in understanding how ecosystems and species will recover. Designation of research areas needs to be based upon the best science available.

Recommendation 5-2: To address bycatch and stock assessment problems:

- a) Vessel Monitoring Systems (VMS) need to be mandatory to aid in area-based management of fisheries.
- b) Full compliance with observer-on-board or video surveillance for assessment is too costly to the industry. The need to improve reporting must be mandatory and accurate, with enforcement by penalties or incentives. The utilization of random black box video monitoring of vessels may be an adequate incentive.
- c) Incentives to reduce bycatch need to be clearly established, such as incorporating bycatch into quota or trip limits.
- d) Develop incentives for accurate reporting of catch and bycatch to aid in accurate stock assessment.

Issue 6: Overfishing in international waters impairs the health of global marine fisheries.

Recommendation 6-1: The US needs to encourage the international fishing community to adopt the 1995 Straddling and Migratory Fish Stocks Agreement. The exclusion of several countries makes this agreement non-functional, which affects US resources. We also recommend that the USDA provide the fishing industry and consumers with standards, education and labels to ensure import and export comply with proper management of fishery stocks.

Issue 7: Nonpoint source (NPS) pollution—NPS pollution entering the coastal zone is a problem of national scope needing national level solutions, yet even coastal NPS pollution programs are massively under-funded.

Findings: Attempts to integrate non-point source pollution best management practices through Coastal Zone Management Act (CZMA) land use controls have been a qualified success at best. Although there are many contributing factors to this failure, the primary reason for this breakdown is the lack of resources appropriated to existing programs. Under the Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990, the Office of Ocean and Coastal Resource Management administers the coastal non-point pollution control program. Thus far, Section 6217 has been slow to develop and only four states have been approved for their non-point source pollution control plans.

Recommendation 7-1: An integrated approach over entire drainage basins is needed to control and reverse NPS pollution. While encouraging states to extend coastal boundaries to incorporate entire watersheds is a start, a national strategy for controlling NPS pollution with a true financial commitment from the federal government is needed to generate state participation through the CZMA. Using the “polluter pays principle,” the federal government should assist the states in integrating voluntary and mandatory approaches, using incentives and disincentives as needed.

Issue 8: Invasive Species—Given the potential for significant future ecological and economic harm posed by marine invasive species, current methods of monitoring, control, and prevention are not sufficient.

Findings: As the rate of marine invasions has climbed, the need to learn more about invasive management and control has become more apparent. In the United States alone, estimates made by the Pew Ocean Commission for the cumulative losses from invasive marine species is in the billions of dollars. Research by D.R Lassuy indicates that nonindigenous species have contributed to 68% of the fish extinctions in the past 100 years, and the decline of 70% of the fish species listed under the Endangered Species Act. Invasive organisms are considered second only to habitat loss when it comes to reduction in biodiversity. Once invasive marine species have become established, it is almost impossible to get rid of them. Therefore, the key to wise stewardship practices is prevention of initial introduction.

Potential methods of introduction include ballast water exchange, intentional release (i.e. for fisheries enhancement), fouling, being mixed in with intentionally imported items (i.e. shellfish), and dispersal from neighboring areas. In the marine realm, the most prominent vector of introduction is ballast water. The potential for species transfer is compounded by the sheer amount

of ballast water. In U.S. waters, an average of 2 million gallons of ballast water is discharged every hour.

Open ocean exchange is not feasible in all situations, nor is it completely effective because residual numbers of coastal organisms may remain. Research (see Harder, 2002) is underway, testing a variety of promising ballast treatment techniques.

Public and stakeholder outreach and awareness programs need to be developed to instill both a love for the oceans and a desire to protect it from threats such as those posed by invasive species.

Recommendation 8-1: In the next 20 years, U.S. foreign trade is expected to more than double in capacity, and in order for people to become better stewards of the marine environment, there is a need for heightened reality in ocean and coastal budgeting. The Commission should recommend increased funding for invasive species research, monitoring, and control efforts. The “polluter pays” principle should be employed, that is, the entire marine transportation industry should be engaged and made at least partially responsible for costs associated with ANS reduction measures.

Recommendation 8-2: Involve the American Association of Port Authorities (AAPA). The AAPA represents “virtually every major U.S. public port agency” and therefore must step up and help facilitate the battle against new marine invasions. Port authorities already recognize their role as environmental stewards and invest significant amounts of money into projects with this purpose.

Recommendation 8-3: With respect to ballast water controls:

- a) Implement a compulsory ballast management program on a national level. Not only must funds be made available for enforcement purposes of open-ocean exchange (primarily by the U.S. Coast Guard), but significant financial incentives must also exist to prevent rule infractions.
- b) Improvements to existing and new vessels entering the maritime transportation industry. More efficient ships, capable of operating with less ballast water and doing so safely in open ocean situations, would reduce the risk posed by ANS.
- c) Utilize the classification system currently in place within the maritime transportation industry. Classification societies such as the American Bureau of Shipping (ABS) are already establish and verify industry accepted standards, therefore, if these standards are going change, it is necessary to involve them in the design and implementation process. In order to reduce uptake requirements, but maintain vessel safety while at sea, design plans need to include ballast tank improvements. Vessels are subject to periodic surveys of their hull and machinery in order to remain in class. Expand periodic inspections to include hull inspections, cleansings and ballast system maintenance.

Funding should be made available for research on improving ballast water treatment methods. Current treatment methods include ozone/nitrogen treatment, disinfectant/ biocide treatment (i.e. vitamin K which kills 90-95% of marine microorganisms), ultraviolet radiation exposure, centrifugation, and filtering with fine mesh sieves.

Recommendation 8-4: With respect to intentional and fouling introductions:

- a) Implement national intentional introductions program and a compulsory fouling management program to coordinate regional efforts.
- b) The U.S. Fish and Wildlife department and the National Marine Fisheries Service (NMFS) should be in charge of regulating intentional introductions, and coordinating state efforts.
- c) The U.S. Coast Guard should take the lead in the fouling management program, developing more environmentally friendly antifouling treatments and enforcing regular hull cleansings.

Recommendation 8-5: With respect to education on marine invasive species:

- a) State watershed councils should be involved, and educational materials should be provided to them in order to inform them of their duties as marine stewards.
- b) Environmental education efforts in K-12 curricula should be expanded to include invasive species information, as should widely visited sites such as aquariums.

OCEAN AND COASTAL RESEARCH AND MARINE OPERATIONS

Issue 9: Long Term Marine Research—Improved understanding and the prediction of ocean conditions is vital to the management of fisheries and other living resources.

Findings: With the recent acknowledgment by the Bush Administration that average global temperatures will increase due to human contributions, there is increasing demand to know how climate change will affect populations and resources. Today scientists can predict the magnitude of impacts of El Nino-Southern Oscillation (ENSO). Ocean currents on the West Coast influence climactic phenomenon similarly as important as ENSO, such as the Pacific Decadal Oscillation.

Recommendation 9-1: The establishment of a buoy array spaced 100 km apart along the West Coast of the US covering coastal waters and waters of the EEZ would help oceanographers and atmospheric scientists to create models for ocean and atmospheric conditions. As well, it would establish a baseline of information to aid in monitoring global warming and natural climatic oscillations. This array would also assist in ground truthing for remote sensing data, providing missing links of the lower water column and data when satellite information is unreliable or unattainable. The array would also aid in navigation and weather forecasting. The buoy array should incorporate the international support of North Pacific Nations.

Issue 10: Regional Ocean and Coastal Vessel and Technological Research—The coastal processes influencing the environment off the Pacific Northwest’s coast needs to be understood to help with management of coastal resources. Until the mechanisms for these processes are clearly understood, the West Coast will continue to be susceptible to unnecessary damage from oil spills, coastal mismanagement and fishery management.

Findings: Recent interdisciplinary research off the Oregon Coast by the Coastal Ocean Advances in Shelf Transport (COAST) study has provided clearer understanding for chemical, physical and biological influences on complex environments.

Recommendation 10-1: CZMA section 309 should be utilized to provide grants for oceanographic research to states as incentives to continue programs, like COAST, to establish models for coastal management. Additionally, we recommend continuation of NSF grants benefiting coastal oceanography and atmospheric science. This research is of national interest. The need to maintain a NOAA vessel in the Pacific Northwest will ease the burden of research through the University National Oceanographic Laboratory System (UNOLS) fleet. This information is vital to the development of baseline information for accurate models to show that changing ocean conditions are caused by the effects of complex topography and density layers. The lack of research on the submarine canyons off the Columbia River, Straits of Juan De Fuca and Heceta Bank has been problematic for effective regional management. Also, the recent energy crisis has demonstrated the need to expand research into acquisition of alternative energy sources, this research will also aid in the EIS for OCS developments and aid in analysis for impacts of methane hydrate extraction off the coast of Oregon.

Issue 11: Mapping—There is a need for the development of high definition terrestrial and bathymetric mapping.

Findings: Developments in satellite and sonar remote sensing technology led to a large-scale high definition mapping of the many coasts and estuaries by NOAA, the USACE, and various other agencies in the last decade. Keeping in mind national security issues, increased funding to finish high definition coastal and estuarine bathymetry mapping for the Pacific Northwest will aid in the management of shipping, fisheries, human population growth and coastal hazards.

Recommendation 11-1: Funding for bathymetric mapping of topography should be increased. Combined with data of environmental conditions and geological substrate attributes, this technology will help NMFS designate essential fish habitat and thus support compliance with the Sustainable Fisheries Act. Funding is also needed to complete high definition coastal and terrestrial mapping to aid in growth management, estuarine and riparian restoration, and hazard prevention. These proactive management tools will curb economic losses significantly for the future promoting regional stability.

Issue 12: Protecting Estuarine Areas for Applied Research—The diversity of the West Coast’s estuaries and resources are not adequately represented in research and management areas of the National Estuarine Research Reserves.

Findings: Even though the West Coast represents a small fraction of the nation’s estuarine systems, they are of vital importance and understudied for management of sustainable resource management. In the Pacific Northwest, Padilla Bay and the South Slough National Estuarine Research Reserves have been providing tremendous information needed for management of estuaries and coastal waters. However, they alone cannot cover the complex nature of the Pacific Northwest. Species diversity and complexity, exotic species management, human population growth, fish maturation, chemical pollutant treatment and bioaccumulation have not been adequately addressed on the West Coast. Federal support is needed to combat these regional problems.

Recommendation 12-1: Create a minimum of three additional NERRs located in:

- a) California's Humboldt Bay to address population growth, historical loss of tidal marsh habitats, and species diversity changes due aquaculture and invasive species introduction.
- b) Willapa Bay to study Washington's coastal species diversity, aquaculture impacts and chemical treatments for shrimp, and *Spartina alterniflora* control practices.
- c) An additional NERRs in a major port of the Puget Sound, such as Bellingham, Tacoma, Seattle or Olympia, to aid in research of contaminated sediments, oil spill prevention, exotic species management, salmon restoration, and non-point source urban pollution prevention at storm drains.

The goal of establishing additional NERRs would be primarily to analyze how ecosystems are affected by the human environment and determine appropriate methods to manage cities that are degrading or competing for the resources within the estuarine

Issue 13: Marine Environmental Protection and Industry—Issues of responsibility and accountability for protection of ocean and coastal resources needs to extend beyond the federal government to the resource users and manufacturers, such as the oil and shipping industries.

Findings: The oil and shipping industries need to institute proactive protective measures against oil spills and ballast water contamination. Precautionary safety regulations for all open ocean ships need to be in place to prevent shipping disasters, such as the New Carissa grounding at Coos Bay. A rescue tug in the Straits of Juan de Fuca has prevented several potential disasters in the Pacific Northwest.

Recommendation13-1: Legislation providing federal or industry funding for rescue tugs and response teams in key locations along the West should be introduced and implemented. This could prevent shipping disasters along the West Coast in the winter months. Funding to support additional tugs in strategic locations along the West Coast ideally would shift away from the government towards the oil industry or consumers.

MARINE EDUCATION

Issue 14: Coordination and Leadership in Marine Public Education—**The lack of a unified policy on public education about ocean resources is hindering support of ocean research and management.**

Findings: The success of future ocean research and management hinges on public support. While there is significant public interest in the ocean today, there is a general lack of understanding about how ocean processes work and the importance of associated management issues. The federal government has the responsibility, as a major participant in ocean interactions, to foster understanding and accountability among all of its citizens. The lack of a strong ocean education policy has severely limited the public's understanding of ocean issues and allowed the proliferation of misinformation.

Recommendation 14-1: Establish an ocean education council that is responsible for determining ecological and management issues of greatest concern to the entire country. The council would develop plans for the dissemination of educational material. The range of ocean issues today, such as invasive species, fisheries management problems, climate change, and ocean pollution could be areas of educational emphasis. The ocean education council could be housed within the Department of Education or under the proposed National Ocean Council.

Recommendation 14-2: Encourage scientists to communicate their research to the public by providing training and incentives. Training programs need to be created, possibly in coordination with universities. Existing programs, such as the Aldo Leopold Program, could be expanded to provide opportunities for ocean scientists to improve public communication skills.

Recommendation 14-3: Hire science publicists to communicate university or federal marine research and management information to the media. Often, it is difficult to understand the implications of scientific research and management. Trained ocean science and management publicists are needed to convey this complex information to the public in a format that is easily understood.

Issue 15: K-12 Education—Children in kindergarten through 12th grade are poorly educated about ocean science and management issues.

Findings: The Ocean Exploration Initiative (OEI) Education Advisory Committee found that the most troubling issue regarding K-12 education is that there are no requirements in the National Science Standards for areas of study involving oceans and coasts. Textbooks on oceans are scarce, however significant curriculum is available in various forms through many federal and non-government organizations such as Estuarine Research Reserves, aquariums, the Environmental Protection Agency, university marine labs, local watershed groups and the Ocean Exploration Initiative. These organizations all have programs and curriculum for marine education, but they are fragmented and their availability may not be known to teachers.

Recommendation 15-1: Incorporate ocean science and management curriculum as part of the National Science Standards.

Recommendation 15-2: Establish ocean education coordinators for each coastal zone state. State instituted marine education coordinators would be responsible for maintaining partnerships of schools with governmental and non-governmental ocean programs. Funding for ocean education coordinators could be included in federal Coastal Zone Management section 309 amendments or as part of Sea Grant funding.

Recommendation 15-3: Include ocean and marine science and management issues within state and federal K-12 testing standards.

Conclusion

Thank you for the opportunity to present recommendations for improved ocean and coastal management in the United States. In order to meet the needs of current and future generations, adaptation of the present regime is critical. Within this document, a number of works were referenced regarding the need for improved ocean and coastal governance, stewardship, research, and education. For more comprehensive analyses of the issues presented, following is an extensive list of sources in which experts on these subjects have presented their research.

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